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ABSTRACT

This paper discusses the use of digital cameras in K-12 education. Examples are provided of the integration of the digital camera and visual images into: reading and writing; science, social studies, and mathematics; projects; scientific experiments; desktop publishing; visual arts; data analysis; computer literacy; classroom atmosphere; and assessment. Advantages and disadvantages of using the digital camera in the instructional process are described, and considerations when purchasing digital cameras for the K-12 classroom are summarized, including viewfinders, storage, resolution, lenses, software, virtual reality, and computer applications. World Wide Web sites for more information on the digital camera are listed. (MES)

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Digital Cameras in the K-12 Classroom

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Abstract: Today's digital cameras, electronic devices that merge computer capabilities with traditional photography, have come a long way in affordability and ease of use. Digital cameras can enhance and energize many curricular activities. They allow for instant results, user flexibility, and ownership in the development of the images. Users take pictures in the standard way, store them on a digital disk, and use these images on their computers. Although film based technologies can provide the same opportunities, the use of the digital camera provides a hassle-free way to capture, manipulate, and present images relative to instruction.

As our society relies increasingly on transferring knowledge quickly and easily through visual means, the digital camera provides a powerful tool for customizing the materials we will use to transfer this information. Many of the educational reform movements of today emphasize the importance of designing the learning experience to be relevant to the child's world. A good way to bring the world into the classroom is with visual representations of the content being discussed. For example, a Kindergarten and First Grade classroom activity is the shape walk, in which teachers take their class into the neighborhood where students find instances of simple two dimensional shapes as used in society or represented in nature. Using a digital camera, the student takes pictures of the shapes instead of merely pointing out these instances. As middle grades classes discuss the form and functions of geometric shapes, digital cameras allow the students to take pictures illustrating where form enhances function. Examples of such pictures include the rectangular solids used on container ships as an efficient way to load and unload cargo or spherical gas storage tanks as representation of shapes that provide strength to resist internal pressures. A high school Geometry experience designed to develop an appreciation for geometric theorems, might include visual images. The digital camera could be used to: 1) take pictures of a building and insert the pictures into a draw program, 2) superimpose a grid over the inserted image, and 3) use the image to calculate an equation for an architectural feature such as an archway.

Additional geometric applications might be to illustrate the Golden Rectangle, a rectangle with an approximate proportion of 2 to 3, a feature of classic Greek architecture that is considered to be the most esthetically pleasing proportion to the human eye (Jurgensen, Brown, & Jurgensen, 1988). Another activity could include taking pictures of three dimensional structures at a corner and inserting the pictures into a draw program so that lines can be drawn to show perspective and vanishing points.

Today's definition of literacy moves the focus of literacy beyond facility with the printed word and toward acquiring a knowledge base. The definition of a literate person is evolving to include the ability

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to gather and impart information in a visual format. The delivery and acquisition of this information includes visual images. The instructional process should include providing today's students with proficiency in the skills necessary for handling visual information (Crockett, p.5). The digital Camera provides a tool to develop this form of literacy in the same way that word processing does for the printed word.

Integration of the Digital Camera into the Instructional Process

Within the P-12 curriculum, use of the digital camera is only limited by one's imagination. Some instances of integration of visual images into the instruction process of common content areas are:

- Reading and Writing - This application combines reading with the visual arts and writing skills. Descriptive language can be developed by taking a picture and asking the student to describe the content of the picture, either orally or in a written format. Conversely, the teacher could describe an object or situation either verbally or in written form and ask the students to create a picture of the description. As the students develop these skills, their communication abilities are advanced through creation of a picture book or story, a storyboard for a play, or a record of an experience that imparts information both visually and verbally.

- Science, Social Studies and Mathematics - Images can be used to prepare for, document, and follow up on, field trips in the content areas. A teacher's visit to the field trip site prior to the trip to record images that the students will observe creates a visual record to serve as an advanced organizer. As part of the actual trip, students take pictures. Follow up activities include reports or further study of aspects of the trip. For example, a field trip to a historic town could include the architectural aspects of the town. On a pre-trip visit, the teacher takes pictures of various types of architectural designs to share with the students before the trip. While on the trip, the students record their observations, both similar to and different from the architecture features the teacher observed. Reports developed as a result of the trip might include researching the defining features of an architectural style, and analyzing whether the designer/builder of a particular building incorporated more than one architectural style. Identifying the mathematical considerations that are apparent in the design of a structure, and how the design of the structure relates to it's function are also questions to be considered.

- Projects - As students create projects in the classroom they take pictures to record the process and results of the project. A class working on folk art could take photographs of the quilts in their families. The students could then create a database for use in discussing: 1) the differences and similarities of the quilts, 2) the materials used to create a quilt, 3) the lives of the people who created them, 4) how the designs reflect the life of a quilter, and 5) the geometric patterns and tessellations required to make a quilt.

- Scientific Experiments - Students use the digital camera to record their observations in a science experiment that involves change over time. The growth of a plant or animal, the change in a specific site over seasons or years, or the effects of a chemical reaction are all possible situations which can be recorded by a series of images.

- Desktop Publishing - Student reporters for class or school newsletters take pictures of special events, students, and faculty to illustrate articles.

- Visual Arts - The aesthetic aspects and critical analysis of an image are explored by discussing the organization of visual space to convey a feeling, action, or documentation. The display of the images, criteria for selecting images, and how an image can convey a message in place of words are all considerations. Additionally, using an image to complement text, the manipulation of images to create a new image, and the isolation of certain aspects of an image to focus on a specific idea, are important aspects of visual imaging and communication.

- Data Analysis - Students using the digital camera can create a visual field in the database. A class that is studying the birds observed in the schoolyard could create a database of each bird viewed. The time sited, color of plumage, whether the bird is a juvenile or adult, if the bird is migratory or residential, its feeding and nesting habits, as well as an actual picture of the bird could be included. If multiple entries for each bird occur, students can analyze the data to determine if the siting were of unique birds or if a repeat siting of a single bird occurred. A teacher could also build a database over several school years providing the opportunity to track birds over time. Another application involves creating of a database of American Sign Language (ASL) to provide learners with images of each letter and of common phrases. The ASL could also be useful for special need learners.

- Computer Literacy - Most state and local school districts are beginning to require a computer literacy component in their graduation requirements. The digital camera is a vital part of this process and provides images that are integrated into web pages and presentation programs.

- Classroom atmosphere - Many teachers use pictures and images to highlight each student's special characteristics in order to build self-esteem and a sense of place. A picture emphasizing a child's special characteristics and their contributions to the classroom becomes the vehicle for building classroom pride. Use of a digital camera helps facilitate this idea by showing the strengths and actions of each student and helps them see themselves as part of the classroom community. Students with special needs who are encouraged to use the camera to record projects and information are given a powerful tool to help them participate in classroom learning activities and improve their self concept.

- Assessment - In assessing learning, digital images can be used in construction of traditional tests and in production of alternative assessment documents. Tests created that include images of items or processes from classroom experiences give the teacher an opportunity to develop test items that relate to the student's experiences. Authentic assessment is achieved with the inclusion of images that students have taken of their work in portfolios documenting a greater variety of work than might otherwise be included.

Advantages and Disadvantages of using the Digital Camera in the Instructional Process

When using visual images in the classroom, making the decision to include the digital camera to produce the images over traditional methods requires analysis of the camera, the learning situation and the capabilities of the learner. Several advantages and disadvantages present themselves for consideration when selecting an imaging option using a digital camera. First, and probably most important, are the advantages.

Advantages

Photographing with a digital camera is almost instantaneous. Images can be viewed and/ or downloaded immediately and used at the "teachable" moment. Additionally, images can be analyzed and retaken immediately on site, if desired. The capability to delete unwanted images immediately is also a plus, allowing the user to manage storage space. Film cannot be inadvertently exposed using a digital camera thus preventing the loss of an image that is common when a traditional camera is used.

Cost, following the initial outlay of funds for a digital camera and storage device (flash card or floppy disk) is minimal. Therefore, one time funding provides equipment and materials for use over several years. Eliminating continuous cost frees teachers and student to use the camera frequently.

Several features are evident in all digital cameras. They include a Liquid Crystal Display (LCD) screen and storage format. Many cameras use the LCD as the viewfinder allowing the user to see exactly how the picture is composed prior to taking the picture. Most digital cameras also allow the user to adjust the resolution of the image before the photograph is taken.

Digital cameras save pictures in standard JPEG format that is compatible with a wide variety of computer programs. When JPEG images are used they can be easily inserted and integrated into word

processing, database, desktop publishing and presentation programs. Use of the digital camera eliminates a step in the process of including images in a computer presentation. If traditional photographs are used, they must be scanned into the computer adding an additional step in the imaging process. The extra step increases the cost of the imaging by requiring the purchase of another piece of equipment. Additionally, the learning curve is increased due to the fact that the user must master the use of the scanner and its associated software. The quality of the digital camera images is as good as or better than a scanned photograph when used in computer applications.

Finally, a number of digital cameras also have video-out ports, this feature permits the projection of the digital image on a television screen or monitor and is especially helpful if a computer is unavailable in a classroom.

Disadvantages

There are, however, some obvious disadvantages in using a digital camera in the educational environment. The initial cost of one digital camera exceeds a number of regular "throw away" traditional cameras. However, the one time cost of a digital camera is offset when the continuing cost of film and developing is considered.

A second issue is printing. Printing of images that have been taken with a digital camera on either an inkjet or laser printer may diminish the quality of the printed photograph due to the printing process and the paper that is used.

Lastly, when shooting in an outdoor environment with a digital camera, bright sunlight may prevent the user from viewing the LCD. Thus, the ability to compose, focus and review an image is greatly reduced unless the user makes some provision for shading the LCD.

Considerations when purchasing Digital Cameras for the K- 12 Classroom

When considering the purchase of a digital camera several questions must be answered. Who is going to be the primary user, a student (and of what age) or a teacher? A camera designed for an adult might prove too difficult for a young child to use. Another question to ask is: How and for what purpose will the camera be used? Therefore, when purchasing a digital camera, one needs to pay attention to the various features offered. These features include:

Viewfinders. Does the camera have an optical viewfinder or a LCD screen? LCD's let you view the pictures you've just taken allowing the user to decide to retake the pictures or delete them from the cameras that only have LCD's (no optical viewfinder) tend to suffer from two problems: they use up batteries quickly and can be hard to see in bright daylight. The best bet is to look for a camera that has both a LCD and optical viewfinder.

Storage. Today's cameras store images on a number of different types of media. The most common is the Flash Card and associated compact Flash Card. These cards come in various sizes from 8mb up to cards that hold over 256mb of information. If a computer is equipped with a PCMCIA slot, one can transfer the images on these cards directly into the computer more quickly than by cable. The Sony Mavica camera uses standard 3.5" HD floppy disks. The picture files can then be used in any computer with a standard floppy drive. This inexpensive media would allow every student to have their own storage disk and edit the pictures on any computer, at home or school.

Resolution. Cameras with higher resolutions produce sharper images. The least expensive digital cameras have the lowest resolutions, 640 x 480 is the minimum needed for a decent image. Higher resolutions are especially advantageous for print, as opposed to Web pages and/or presentation programs. The one problem with the higher resolution cameras is that they tend to cost more and the pictures take more storage space. Therefore, one should look for a camera that allows one to change the resolution of the picture before taking it.

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Lenses. Most low-end digital cameras offer fixed-focus lenses, like those on the less-expensive film cameras. Fixed focus lenses are all right in many situations, and are lighter and easier to use than zoom lenses, although it may be more difficult to get the picture desired in difficult situations, for example when taking a picture of a distant object or person. Cameras with zoom lenses allow the user to eliminate distracting backgrounds when shooting, and add to the camera's versatility. However, zoom lenses add to the cost and weight of the camera. At the high end of the price scale are cameras that allow you to use different lenses for different situations. Minolta's digital cameras will work with most of the lenses they make for their 35mm film cameras. Look for a camera that has the type of lens needed for the intended purpose of the camera.

Software. Digital cameras come with a variety of bundled software that will allow the manipulation of the images once they are downloaded into a computer. This software ranges from minimal viewing programs to complete image editors. The two most popular software programs that are currently being bundled are *Adobe Photoshop LE* and *Adobe Photo Deluxe*.

Virtual Reality. - A series of pictures can be taken of a scene that covers a panorama of the site. These images can then be "stitched" together to form a 360 degree panorama allowing the viewer to control the point of view of the scene. The panoramas are initially created by using a tripod with a digital camera to create a series of individual still images. Then the images are imported into a QTVR software package and the panorama is formed. The viewer can then actually experience and control the observation of the site. Several shareware and commercial programs are available to create panoramas. The commercial software programs include Apple's *QuickTime VR* for both Macintosh and PC computers and *VR Worx*, or one of several powerful programs which are easy to use and that can be purchased for under $100 and allow the teacher or the students to develop panoramas.

Computer. Almost all of the digital cameras will work with both the Macintosh OS and Windows computers, but it is important to be sure that the camera comes with the cables and software for the computer which will be used.

Digital Cameras are great learning tools to simulate and motivate students and teachers alike. As teachers use and experiment with digital cameras they will find applications that are unique to their classrooms. The digital camera coupled with other computer applications provides a sound basis for teachers and students to meet the National Educational Technology Standards.

Web Sites

For more information on the digital camera, from how they work to how they can be integrated into the instructional process, explore the following Web sites.

Digital Imaging Resources for Educators
http://www.edb.utexas.edu/regcol/digimg/index.html
Digital Cameras In Education
http://www.ozemail.com.au/~cumulus/digcam.htm
Digital Cameras In Education
http://www.kodak.com/US/en/digital/edu/lessonPlans/lessonPlans.shtml
KODAK: K-12 Solutions - Lesson Plans
http://www.kodak.com/US/en/digital/edu/k12Solutions/index.shtml
Enhancing Learning Through Imaging
http://www.kodak.com/US/en/digital/edu/education.shtml
The Casio Classroom – Technology, Mathematics, and Science Education
http://pegasus.cc.ucf.edu/~ucfcasio/casio.htm

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